Do financial investors affect commodity prices? The case of Hard Red Winter Wheat

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Abstract

The aim of this paper is to assess empirically whether speculative financial investments have affected wheat price dynamics in recent years. To address this issue we will (1) analyze recent agricultural price dynamics and their drivers (2) outline the process of 'financialization' of agricultural commodity markets, identifying the macroeconomic, monetary and legislative factors which favored it and (3) present an econometric analysis using Hard Red Winter (HRW) wheat as a case study. Since 2007 HRW wheat price fluctuations have been positively related to US stock market returns and oil price movements. These correlations appear to be determined by commodity index traders, a category of financial investors, since both these relationships proved to be spurious, with the most tracked commodity index as the confounding variable.

KEYWORDS: Agricultural Commodity Prices, Global Commodity Crises, Financialization, Commodity Futures Markets, Commodity Index Trading, Agricultural Markets, Commodity Futures Pricing

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Introduction

Recent agricultural commodity price fluctuations have raised a wide debate. The sharp price increases in 2007/2008 and 2010/2011, and the even quicker fall that took place between the two spikes, were surprisingly fast and deep. In June 2008 agricultural prices peaked at their highest level in 30 years, and then fell sharply in the next six months. In 2010 there was a new steep rise, with prices peaking in early 2011 at levels higher than those reached in 2008.

These price swings were common to all agricultural (but also energy and metal) commodities, and don't appear to be fundamental-driven, since offer and demand dynamics were not (and probably cannot be) so volatile in the short term. They had a dramatic impact on poverty and food security in many countries. A highly debated and controversial issue is if, and to what extent, these price dynamics were affected by financial speculation.

As a matter of fact, during the second half of the 2000s financial investors flooded agricultural commodity futures markets with what was called a 'wall of money'. This was part of a larger shift in portfolio strategy, which drove financial institutions away from traditional equity markets towards commodity and real estate derivatives (Basu and Gavin, 2011). 2007 saw a huge further increase in commodity derivatives growth, as financial capitals were running away from the collapsing US housing market. Between 2004 and 2008, the notional amount of commodity derivatives traded OTC grew by an impressive 900% and the number of contracts traded in organized exchanges increased by a no less remarkable 214%. After a temporary fall between late 2008 and 2009, commodity derivatives trading restarted growing, reaching new transactions peaks in 2011. Some observers argue that, as a result of these events, commodity futures prices – which represent the benchmark for spot prices – now depend on financial markets' expectations rather than market fundamentals (Unctad 2009 and 2011, Iatp 2011). Time-series recently published by the US market authority (CFTC) show that in the period 2006-2010 speculative transactions by financial investors played a main role in price formation in all agricultural commodity futures markets.

The remarkable growth of financial speculative investments in commodities was fuelled by a mix of macroeconomic, monetary and legislative factors, which we try to identify in the second section of this paper.

In the third section we present an econometric analysis, using Hard Red Winter (HRW) wheat price as a case study. HRW is the most traded wheat in international markets, and according to the FAO its price represents the benchmark for all international wheat prices. In a first stage of the analysis we directly test the relationship between financial speculative investment flows and HRW wheat price fluctuations. This direct approach is limited by a lack of information: available data only cover some centralized exchanges, time-series are short and they present several flaws. In a second stage of the analysis, more indicative because of a better availability of data, we use an indirect approach which mainly focuses on the evolving relationship between wheat price dynamics, equity market returns and oil prices.

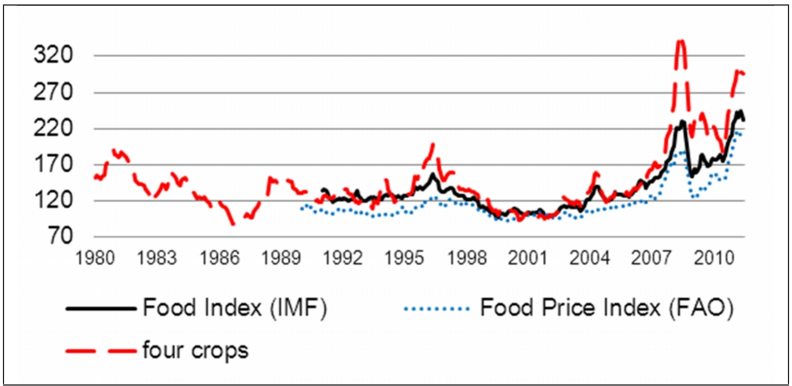
I. Recent agricultural price dynamics and their drivers

A long phase of stability and moderation in international agricultural prices, which started in the early Eighties, ended abruptly in the second half of the last decade. Crop prices began to rise sharply in 2007, and by June 2008 they had reached their highest level in thirty years. The subsequent reversal was even faster, with prices falling by around 40% in six months (between July 2008 and January 2009). A new surge has been observed since spring 2010, with prices peaking in early 2011 at levels slightly higher than those reached in 2008.

Dramatic swings

These fluctuations are displayed in the patterns of the monthly food price indices compiled by the International Monetary Fund (IMF) and by the Food and Agriculture Organization (FAO) of the United Nations. To arrange a longer time-series, we calculated a price index for the four most traded agricultural commodities (rice, corn, wheat and soybeans)[1]. This four-crop index shows even greater volatility than the more comprehensive indices calculated by the IMF and the FAO (Figure 1.1).

Figure 1.1 – Monthly indices of international agricultural commodity prices (Jan 1990=100)



Source: Author's own elaboration on IMF and FAO data

These events had dramatic worldwide impacts on food security and poverty. Among countries, the low-income food-deficit (LIFDCs) ones were hit the most, as food imports represent a larger share of their balance of payments. Within countries, the most adverse impacts were suffered by low-income families, as they tend to spend a

[1] Similarly to the 'four crops index' calculated by the Us Department of Agriculture (USDA) in their June 2011 report (USDA, 2011). In that report, the USDA Economic Research Service calculates a weighted average of the four crops' prices, while here we calculate a simple average. The resulting time-series is analogous.

larger share of their income on food commodities. According to World Bank estimates, between 130 and 150 million people were pushed below the poverty line by food price increases in 2007/2008, while the FAO has calculated that the number of people suffering from chronic hunger increased by 115 million, reaching the sad record figure of one billion (FAO, 2009; De Hoyos and Medvedev, 2009). Nor did developing countries' farmers benefit from high prices. As a 2009 FAO report shows, they were too disconnected from international markets to profit from high prices, and instead they were hit hard by increasing input costs (FAO, 2009).

A key feature of recent price trends is that they were shared not only by all agricultural commodities (as shown in Table 1.1 and Figure 1.2, with only sugar and rice partially deviating from the common trend), but even by energy and metals (Figure 1.3).

A further – and no less relevant - aspect to be stressed is the strong (negative) correlation between commodity prices and the US dollar exchange rate. It can be reasonably argued that this correlation has existed for a long time, since commodities are priced in dollars on international markets. In oligopolistic markets (such as international agricultural markets), when facing exchange rate variations, exporters tend to move prices, *ceteris paribus*, in order to keep real prices fixed. Nevertheless, this correlation has become remarkably stronger since the late 2000s. As shown in Figure 1.4, the agricultural commodities price pattern became almost the mirror image of the US Dollar exchange rate dynamics.

Table 1.1 – International prices of main food commodities (% change)

	2002-2006	Jan ’07 – June ‘08	June ’08 – Dec ‘08	Dec ’08 – June ‘11
Wheat	63%	78%	-37%	48%
Corn	75%	75%	-45%	96%
Rice	62%	166%	-34%	-6%
Soybeans	52%	116%	-42%	57%
Meat (index)	11%	32%	-18%	42%
Oils (index)	46%	103%	-41%	117%

Source: Author’s own elaboration on IMF data

Figure 1.2 – International agricultural commodity prices: wheat, maize, rice and soybeans

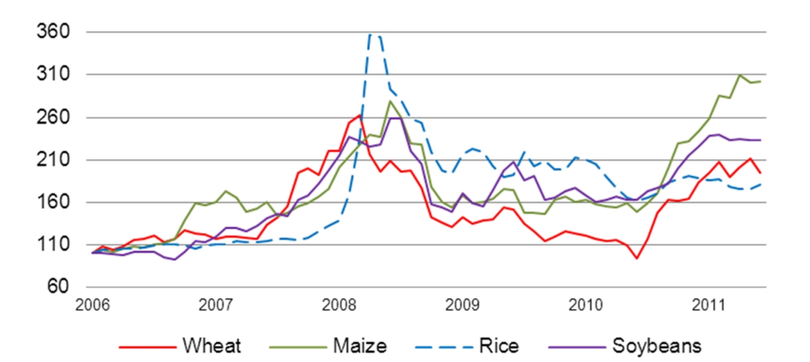
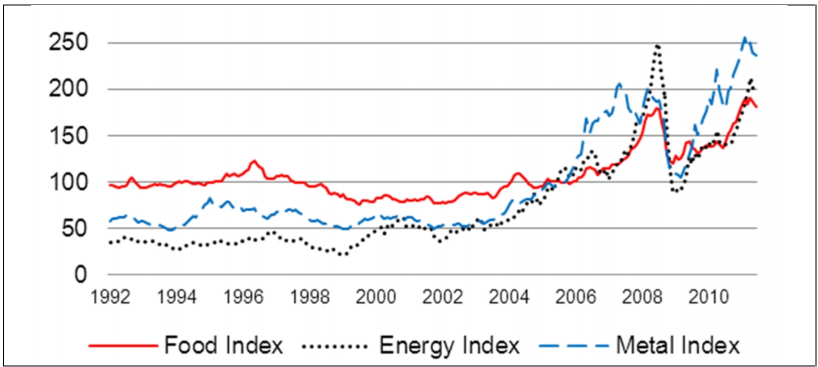
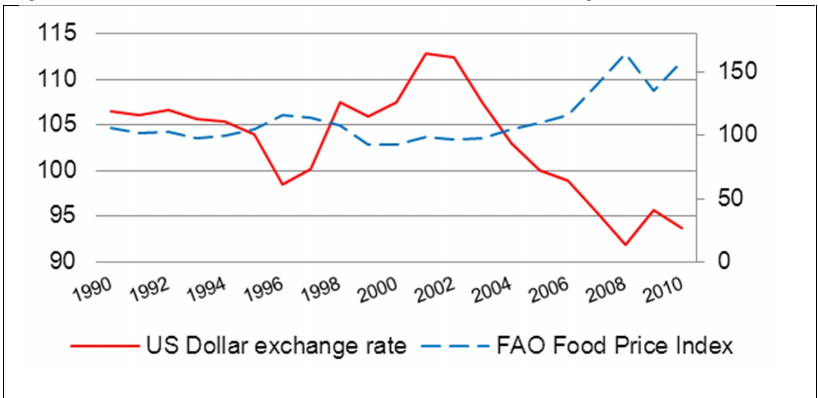


Figure 1.3 – IMF price indices of food, energy and metal commodities



Source (Figures 1.2-1.3): Author's own elaboration on IMF data

Figure 1.4 – FAO Food Index and US Dollar exchange rate*



Source: Author's own elaboration on USDA and FAO data

* We use the Agricultural Weighted Exchange Rate (calculated by the USDA), a weighted average of the dollar exchange rate against a basket of currencies, with weights based on agricultural trade

The main drivers of agricultural prices in the 2000s

There exists ample literature whose aim is to detect the main factors behind recent food price dynamics. From its reading, we can pick out the following most recurring themes.

- **Offer and demand factors**. On the demand side, the growth of emerging countries (often with special regard to China and India) (IMF, 2008), and the increasing demand for biofuels (as a consequence of new incentives and legal constraints imposed in the EU and in the US) (Mitchell, 2008; Timmer 2008). On the supply side, weather-related events in exporting countries (FAO, 2009; USDA, 2011) and the decline of agricultural productivity which has resulted from years of diminishing investment in agricultural research (USDA, 2011).

- **The tightening of world stocks**. According to some authors, stocks reached a critically low level, so the marginal price effect of variations in the production/consumption ratio was much more intense than usual (Abbot et al., 2008 and 2009; OECD, 2008; Dawe, 2009).
- **The depreciation of the US Dollar**. When measured in other currencies, price fluctuations are considerably less dramatic (Abbot et al., 2008).
- **The steep rise in the price of oil**. This factor may have affected supply, through increasing input costs, but most of all demand, causing a higher profitability in biofuels production (Abbott et al., 2008 and 2009; FAO, 2009).
- **Protectionist measures**, implemented in some countries when price increases started to intensify (FAO, 2009; Timmer, 2008).
- **The financialization of agricultural commodity markets**, *i.e.* the strong inflow of speculative investments in these markets, coming from financial actors which are not involved in physical agricultural markets. (Masters and White 2008, UNCTAD 2009 and 2011, OECD 2008, FAO 2009, US Senate 2009, IATP 2011, Gilbert 2008 and 2009).

On the one hand, there seems to be widespread consensus on this list. On the other hand, all the mentioned themes are in some way controversial. In most cases, the disagreement concerns the weights to be attributed to the different issues, and the existence of a dominant factor. The subject of this article – the role played by financial investors – is probably the most controversial among these issues. Some authors consider the steep rise in agricultural commodity prices to be the result of a speculative bubble (Masters and White, 2008; Gilbert, 2009; UNCTAD, 2009 and 2011; IATP, 2008; De Schutter, 2010). Others argue that financial speculation was not influential at all (Irwin and Sanders 2011), while most papers and reports mention the financialization among the main factors behind recent price movements, but state that there is not enough information to quantify its impact. In the remainder of this section we go over briefly some of the points listed above, in order to obtain a synthetic map of the factors which drove international agricultural prices in recent years, before delving into our main subject. We will keep our focus on short-run factors, as we assume that the price impacts of financial speculation are felt in the short term, and not in the long term.

Price formation in the long run and in the short run

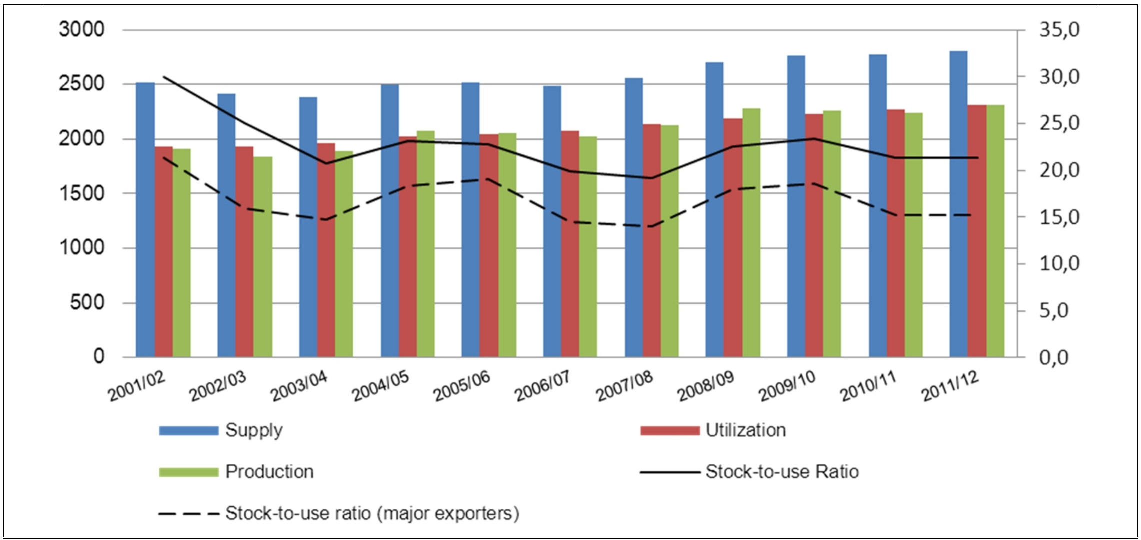
International agricultural prices are moved by a complex interaction between exogenous and endogenous factors. From the perspective of this work, the distinction between long run and short run factors is particularly important, as we are interested in the recent short-term price movements.

Long-term trends (*e.g.* the declining - in real terms - trend which was observed since the end of the Seventies until the first half of the 2000s) are mainly affected, on the demand side, by the world's population and income growth and evolution of dietary patterns, while on the supply side they depend on national agricultural policies, climate change, relative price changes and technological progress. These factors have a slow and gradual – but extremely persistent – impact on prices. They determine structural trends. Short term fluctuations around these long-term trends are instead determined by short-run shocks. These fluctuations can sometimes be ample and quite persistent, because of the low price elasticity which characterizes both supply and demand in the short run. Usually, demand shocks are less frequent but more persistent then supply-driven ones (which mainly depend on weather-related events). Long-term factors were at the root of the reversal of the previous declining price trend which happened during the 2000s. But only short-run factors could have determined the 2008 and 2011 price peaks, and 2008/2009 fall. That is why this article is focused on short term factors. The difficulty of distinguishing between long-term and short-term price drivers is a critical issue which is common to a large part of the existing literature. As a consequence, for example, many works blame the growth of meat and dairy consumption in emerging countries, or population growth, for the 2007/2008 price surge. As effectively stated by Wahl (2009, quoted in De Schutter 2010), it is difficult to imagine that in 2007 a multitude of people *"suddenly developed a taste for consuming vast quantities of dairy products, driving its price up by 157% between 2006 and November 2007, only to lose it starting from July 2008, allowing prices to start falling again".*

Production and consumption and the role of "low" stocks

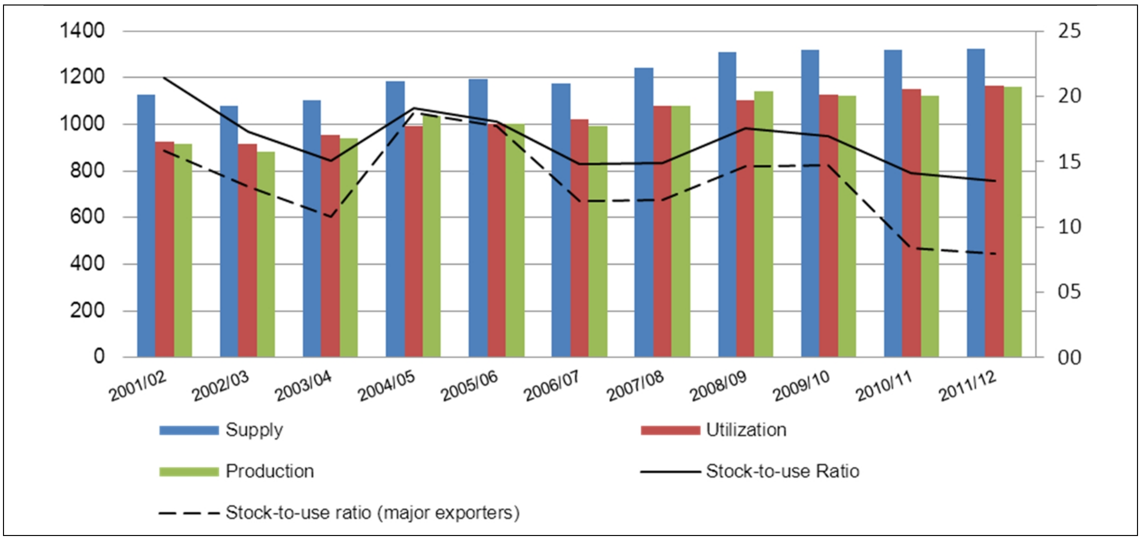
During the 2000s, an overall cereal production deficit was observed in six years out of ten. Consequently, the price trend edged upwards, even if – as we can observe in Figure 1.5 – main exporters' stocks didn't show a clear downwards trend.

Figure 1.5a – World cereal market



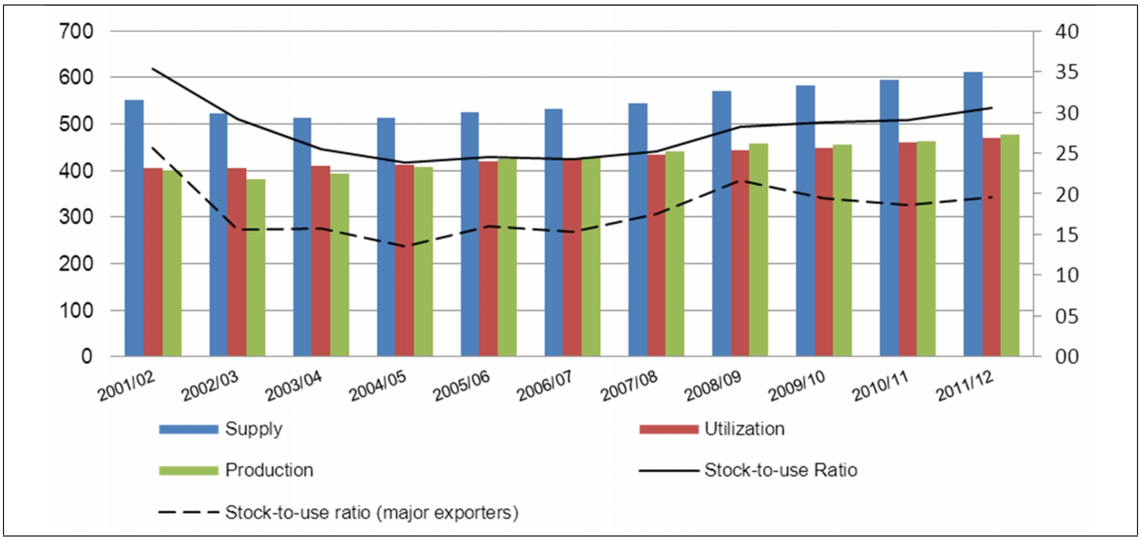
Supply, utilization and production in million tonnes (left axis), stock-to-use ratios in percentage points (right axis)
Source: Author's own elaboration on FAO and USDA data

Figure 1.5b – World coarse grain market



Supply, utilization and production in million tonnes (left axis), stock-to-use ratios in percentage points (right axis)
Source: Author's own elaboration on FAO and USDA data

Figure 1.5c – World rice market

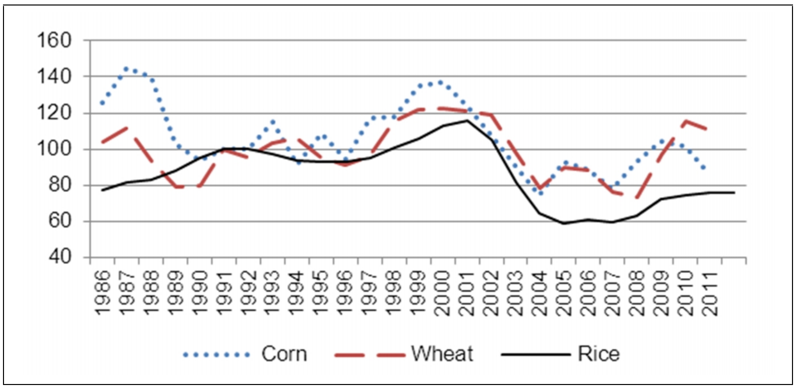


Supply, utilization and production in million tonnes (left axis), stock-to-use ratios in percentage points (right axis)
Source: Author's own elaboration on FAO and USDA data

This dynamic was fueled by slowing productivity growth - outpaced by demand growth - and by some droughts which affected big exporting countries, especially in 2005, 2006 and 2011. On the demand side, the growth in demand for biofuels contributed to the increase in maize (for ethanol) and vegetable oils (for biodiesel) consumption, and influenced all of their substitutes, both in terms of consumption and of land use. Nevertheless, if we stick to the data made available by the FAO and the USDA, physical market fundamentals don't appear to justify the steep price rises of 2007/2008 and 2010/2011. In these years there was no particular consumption peak, nor a significant production fall. Moreover, the fundamentals of each market can help in explaining the differences between the behaviors of each single commodity price, but they can't explain generalized trends which were followed by almost all food and non-food commodities.

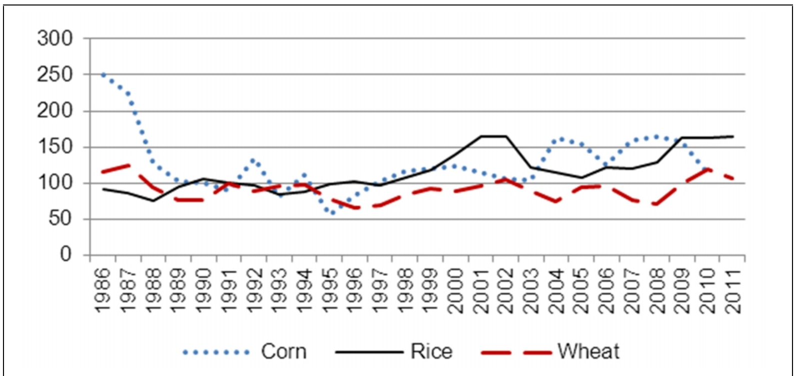
Many authors argue that recent price shocks were caused by the low level of world agricultural stocks (Abbott et al., 2008). Their argument goes as follows: when stocks are rather high, a gap between production and consumption can be easily absorbed without significant impacts on prices; on the contrary, when the stocks-to-use ratio falls to low levels, stocks are no longer seen as an effective buffer which can fill any production gap. In this situation, even small demand/supply shocks can cause huge price shifts. As a matter of fact, between 2004 and 2005 world stocks of all main agricultural commodities reached their lowest level in thirty years (Figure 1.6). On the other hand, as some authors properly observed (Dawe, 2009), the decline in world stocks was just the effect of the planned reduction of huge Chinese stocks. At the beginning of the 2000s, China's stock-to-use ratios of main food commodities were between three and eight times higher than the world average. Starting in 2001, China reduced its stocks, bringing them to a much lower – but still above-average – level. Moreover, China is not a major participant in international agricultural markets, being substantially self-sufficient with regard to almost all the main crops (the only important exception being soybeans). According to FAO and USDA data, the reduction of Chinese stocks didn't have a significant impact on world markets, so it seems more correct to analyze world stocks data excluding China. As shown in Figure 1.7, if we exclude China, world stocks weren't at a low level in the second half of the 2000s, so it seems incorrect to ascribe recent price shifts to low stock levels.

Figure 1.6 – Stock-to-use ratio - World



Source: Author's own elaboration on USDA data

Figure 1.7 – Stock-to-use ratio – World excluding China



Source: Author's own elaboration on USDA data

Macroeconomic factors

As we have just seen, recent agricultural price dynamics are not fully explained by the evolution of market fundamentals, which weren't (and cannot be) so volatile in the short term. Moreover, the recent short-term trends were common to all food and non-food commodities, suggesting that they were determined by common macroeconomic and financial factors. As stated by Abbott et al. (2009), "*Macroeconomic forces have been critical to the recent history of agricultural commodity prices, and will play a key role in determining their future evolution. (…) Market-specific supply and utilization events will, however, continue to drive prices around these macroeconomic and energy market trends".* The US dollar exchange rate and oil prices were the main macro factors which heavily influenced recent commodity price dynamics. As the empirical analysis presented in the third section will show, in recent years there was a clear structural break in the relations between these macroeconomic variables and agricultural prices. Moreover, as we will see, a third important correlation evolved and became significant in recent years: the one between agricultural prices and stock market returns.

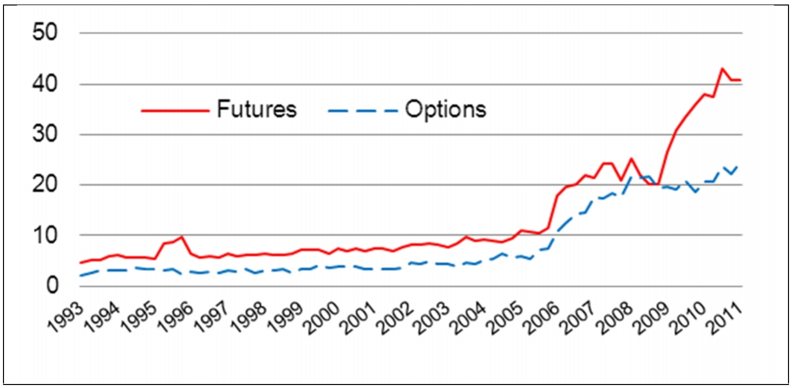
Oil prices and exchange rates may have been two important transmission channels, which allowed macroeconomic and financial dynamics to affect commodity prices. The decline of the US Dollar is an important, but not exhaustive, explanation for the recent price movements. If we examine this effect, by calculating prices in other currencies, the recent price swings are still evident, even if they become less sharp (Abbott, Hurt and Tyner 2008). Biofuel production, influenced by the gasoline price evolution, greatly increased, but – as we have already mentioned – production and consumption dynamics (in which biofuel demand is included) are not able to fully explain the 2008 and 2011 price peaks, let alone the late 2008 price slump. As stated by a 2009 FAO report, *"biofuel demand alone cannot explain the extent of the price increases in 2007 and early 2008"*. Moreover, the 2010/2011 price increases are happening within a framework of a slowdown in the growth of demand for biofuel.

A key feature of the recent period was the unprecedented growth of speculative financial investments in agricultural commodity futures markets. The so-called "financialization" of commodity markets may have been a main factor which allowed the transmission of macroeconomic and financial turbulences to agricultural commodity markets. In other words, speculative dynamics may have been the cause of the structural break in the correlation between agricultural prices, the Us Dollar exchange rate, stock market returns and agricultural prices. As a matter of fact, the new actors that joined commodity markets - investment banks, hedge funds, commodity index funds, pension funds - are traditionally more reactive to macroeconomic signals than to physical agricultural market fundamentals. The next section will describe and quantify the financialization of agricultural commodity markets, and outline its underlying causes, while in the third section we present an econometric analysis, which aims to test empirically the hypothesis that financial actors influenced recent food price dynamics, using Hard Red Winter wheat as a case study.

II. The financialization of agricultural commodity markets

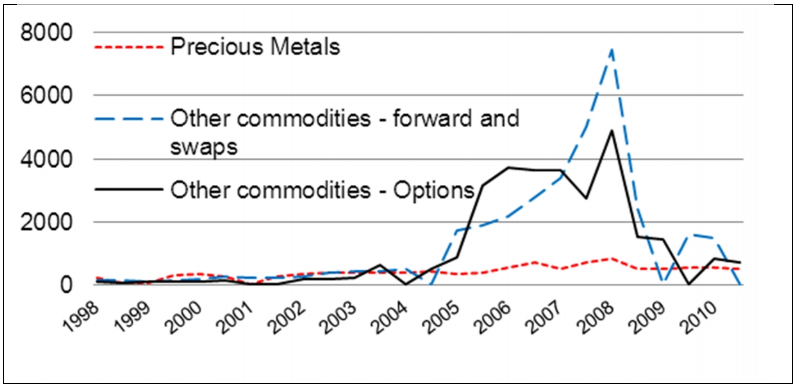
Commodity derivatives markets experienced a remarkable growth during the second half of the last decade, which involved both centralized exchanges and over-the-counter (OTC) transactions. Rocketing transaction volumes and open interest resulted from a huge inflow of financial speculative investments, coming from investment banks, pension funds, hedge funds and other institutional investors.

Figure 2.1 – Commodity derivative instruments traded on organized exchanges (millions of contracts)



Source: Author's own elaboration on B.I.S. data

Figure 2.2 – Notional amounts outstanding of OTC derivatives (trillions of US Dollars)



Source: Author's own elaboration on B.I.S. data

As some market analysts put it, during the 2000s financial investors flooded commodity futures and options markets with a “wall of money”. This was part of a larger shift in portfolio strategy, which drove financial institutions away from traditional equity markets towards commodity and real estate derivatives (Basu and Gavin, 2011). Both in commodity exchanges and OTC, commodity derivatives entered a boom phase in 2005, with a huge further acceleration in 2007.

To understand these remarkable trends, it is helpful to outline a brief timeline. In 1991 Goldman Sachs launched its Commodity Index (GSCI, then S&P-GSCI), a weighted average of different commodity futures prices, *“designed to provide investors with a reliable and publicly available benchmark for investment performance in commodity markets”* (Goldman Sachs & Co., 2004). During the Nineties some financial investors, mainly hedge funds (Basu and Gavin, 2011) started investing in commodities, but it was in the 2000s that the phenomenon took new and more significant proportions. The collapse of the dotcom bubble was a decisive turning point, which resulted in a huge stock market crash. In the aftermath of this crisis a new cycle was opened, characterized by the search for alternative investments. Considerable amounts of capital were moved away from traditional equity markets towards commodity and (above all) US real estate derivatives markets. In 2006/2007, US house prices started to decline, marking the beginning of the US real estate and mortgage market collapse. Consequently financial investors started to turn away from these markets, and many of them diverted their capital into commodities. In 2007 and early 2008 there was a peak in commodity derivatives trading, and at the same time in the price of all main commodities. Between 2004 and 2008 the notional amount of commodity derivatives traded OTC grew by an impressive 900%, while the number of contracts traded in organized exchanges increased by a no less remarkable 214%. The trend was reversed during 2008, when the financial crisis dramatically worsened, becoming a severe and generalized credit crunch (Orleàn, 2011). There was a fall in commodity derivatives trading, as financial institutions were selling their assets in an attempt to get liquidity and cover losses. Commodity prices collapsed. The slump was reversed in late 2009, when a new rise of financial investments in commodities commenced. Financial actors had started making profits again, helped by a huge public intervention, and investments in commodities soared. In the spring of 2011, volume traded in commodity exchanges was 39% above the 2008 peak, while data on OTC transactions are not available yet.

These events were allowed to happen by a process of deregulation of commodity futures markets, the main steps of which were the exemption of some financial actors from speculative position limits (starting in 1991), and the deregulation of OTC markets (with the Commodity Exchange Modernization Act of 2000).

The case for commodities as an asset class

Besides the vicissitudes of financial market developments, we can recognize three main factors at the root of the new appeal of commodities as an asset class. On the one hand, low interest rates set by the Federal Reserve pushed up the demand for any risky asset, as the lower cost of credit caused risk premiums to decrease. Moreover - and no less decisive - there was a widespread (and not completely groundless) belief that a *new commodity super-cycle* had just started, sustained by growth in emerging countries. Last but not least, some influential studies – market analyses by financial firms and also academic papers - claimed that not only commodities were a profitable investment, but that they even represented a hedge against the economic cycle. Actually, the existence of a negative correlation between commodity cycles and economic cycles is rather counterintuitive – except for some precious metals – and was later disputed by several empirical works (for example Buyuksahin et al., 2008). The most influential was probably a 2004 paper by Gorton and Rouwenhorst. Using a four decades long time-series (1959-2004), they simulate a long-term investment in a commodity index, with a rolling strategy of substituting each near-maturity futures contract with the next. (The same strategy adopted by commodity index funds, which in that period were starting to gain popularity). Gorton and Rouwenhorst showed that such a strategy would have entailed broadly the same mean return of an index-based equity investment[2], with the same risk premium (as measured by the Sharpe ratio). More importantly, they showed the returns of their simulated investment in commodities to be negatively correlated with the equity index returns and with bond yields, and positively related to both expected and non-expected inflation. The authors, and with them many financial actors, inferred from

[2] The equity index considered in their paper is the S&P 500.

these results that commodities were a hedge against the economic cycle (Gorton and Rouwenhorts, 2004). In the same month (June 2004), Goldman Sachs published a report entitled *“The Case for Commodities as an Asset Class”,* in which the investment firm *“recommends a strategic allocation to commodities as a separate asset class to hedge macroeconomic risk, decrease expected portfolio risk and to increase expected portfolio returns”* and claims that *“commodities are significantly negatively correlated with both Bonds and Equities. This implies that the volatility of a portfolio can be significantly decreased even by allocating only a small percentage of the portfolio to commodities”* (Goldman Sachs & Co. 2004).

Agricultural commodity markets and financialization

Disaggregated data about agricultural derivatives markets are available only for US commodity exchanges, and are provided by the US market authority (CFTC). These time-series (Figure 2.3) show that agricultural commodities were part of the new investment strategies. Transaction volumes and open interest consistently soared in all US agricultural exchanges, with increases between 200% and 400% in the period 2004-2008. All these markets experienced a slump in late 2008, with a new rise starting in late 2009. The correlation with the price dynamics is clear, but what we don’t know (and will try to discover through empirical analysis in the next section) is if financial investors actually influenced prices, or if the causality was reversed, with investors entering and exiting the market in reaction to price movements and expected price movements.

CFTC data even show that in the period 2006-2010 (the only one for which reliable data about the composition of the market are available) financial investors held a major part of the open interest in all US agricultural commodity exchanges. In particular, most financial investments in agricultural commodities were made through commodity index funds.

Table 3.1 – Agricultural commodities futures market composition – period 2006-2010 (Millions of contracts*)

Wheat Futures - Chicago Board Of Trade					
	Volume	Long	Short	Total net positions	Net positions %
Commercial Hedgers	69.0	16.5	52.5	-36.0	**38%**
Money Managers	33.1	13.6	19.5	-5.9	**6%**
Index Traders	58.8	53.4	5.4	48.0	**50%**
Non-reported	25.3	9.6	15.7	-6.1	**6%**
Total	186.2	93.1	93.1	0.0	**100%**

Wheat Futures - Kansas City Board Of Trade					
	Volume	Long	Short	Total net positions	Net positions %
Commercial Hedgers	29.3	8.7	20.6	-11.9	**43%**
Money Managers	11.4	8.4	3.0	5.4	**20%**
Index Traders	8.8	8.5	0.3	8.3	**30%**
Non-reported	13.7	6.0	7.7	-1.8	**7%**
Total	63.2	31.6	31.6	0.0	**100%**

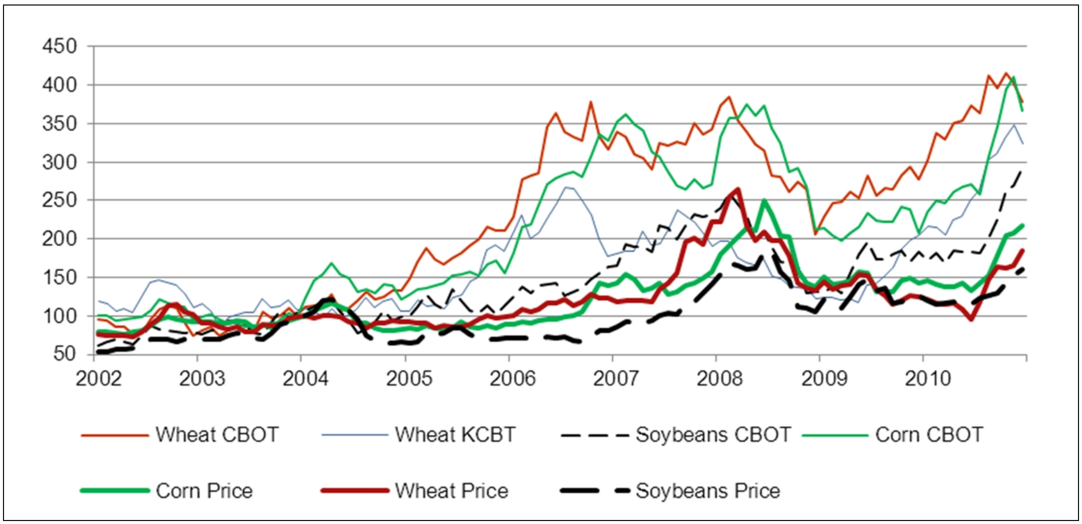
Corn Futures - Chicago Board Of Trade					
	Volume	Long	Short	Total net positions	Net positions %
Commercial Hedgers	294.6	95.9	198.6	-102.7	**39%**
Money Managers	84.2	58.0	26.1	31.9	**12%**
Index Traders	113.6	106.1	7.6	98.5	**38%**
Non-reported	120.2	46.3	74.0	-27.7	**11%**
Total	612.6	306.3	306.3	0.0	**100%**

Soybeans Futures - Chicago Board Of Trade					
	Volume	Long	Short	Total net positions	Net positions %
Commercial hedgers	101.4	30.0	71.3	-41.3	**41%**
Money Managers	33.6	22.8	10.8	12.0	**12%**
Index Traders	43.7	40.9	2.8	38.0	**38%**
Non-reported	41.8	16.5	25.3	-8.7	**9%**
Total	220.5	110.2	110.2	0.0	**100%**

**A contract amounts to 5.000 bushels*

Source: Author's own elaboration and computation on CFTC data

Figure 2.3 – Agricultural commodity derivatives on centralized exchanges
(Open Interest and prices, 2004=100)



Source: Author's own elaboration on CFTC and IMF data

The actors in the agricultural commodity derivatives market

Before presenting the empirical analysis, it is worth clarifying who are the main actors in the agricultural commodity derivatives markets, and which aims and strategies they bring forward. Commercial operators trade commodity derivatives to hedge their future physical transactions, while financial investors intervene in those markets in order to profit from price changes, to diversify their portfolio, and/or to hedge against inflation and the depreciation of the US dollar. Financial investors operating in commodity markets can be divided into two categories, which we call commodity index traders and money managers. Commodity index traders are passive agents whose aim is to gain exposure to commodities as an asset class. They do so by tracking a commodity index, which is a weighted average of different commodity prices, with fixed weights (mainly) dependent on world production and updated once a year. To invest in commodity indices, investors buy financial instruments whose value is proportional to the value of the indices. These instruments – swap agreements, ETFs and ETNs – are typically offered by large financial institutions. It is the latter who practically buy commodity futures contracts, in order to hedge their commitment with their clients. By contrast, we call active investors, or money managers, all the financial investors who don't track a commodity index, but actively buy and sell futures contracts in an attempt to anticipate price changes.

III. A case study: 'Kansas City Hard Red Winter' wheat

Objectives and main findings

Our aim is to assess empirically whether speculative financial investments have affected wheat price dynamics in recent years. In particular, we focus on Hard Red Winter (HRW) wheat price. HRW is the most traded wheat in international markets, and according to the FAO its price represents the benchmark for all international wheat prices. HRW wheat futures contracts are traded on the Kansas City Board of Trade, which publicly release daily prices and transaction volumes on its website.

Two separate analyses were performed. In the first we directly test the relationship between financial speculative investment flows and HRW wheat price shifts. This first analysis is limited by a lack of information: available data only cover centralized exchange transactions, time-series are short (data are available only for the period 2006-2010, so we can't investigate any potential structural break introduced by financialization), and they present several flaws (enumerated for example by Tang and Xiong, 2010, pp.10). In the second analysis, more indicative because of a better availability of data, we investigate the evolving relationships between wheat futures prices, US stock market returns, oil futures prices and the US dollar exchange rate.

The results obtained can be summarized as follows:

- HRW wheat prices tend to get higher as the market share of financial investors increases. However, correlation doesn't necessarily imply causation, and even if it did, we would not be able to assess the direction of causality.
- Since 2007, HRW wheat price shifts are positively related to US stock market returns and oil price shifts. These correlations appear to be determined by commodity index traders, a category of financial investors, since both the relationships proved to be spurious, with the most tracked commodity index as the confounding variable. These results proved to be robust to the introduction of some control variables, namely the US dollar exchange rate, gasoline price (which determines the profitability of biofuels) and a temporal dummy variable accounting for the global recession.

Related works

Several works aim to assess the impact of financial investments on commodity prices. Gilbert (2009) tested several commodities' price dynamics in order to find evidence of speculative bubbles, caused by feedback trading or by index trading. Only in a few commodity markets – in particular soybean and copper – his models point to a speculative bubble caused by extrapolative expectations, while in many he finds evidence of a bubble caused by index traders. Other works (in particular Hernandez and Torero, 2010; Irwin *et al.*, 2009) investigate the issue using Granger causality tests, with mixed results. More closely related to our article are the works of Tang and Xiong (2010) and Buyuksahin and Robe (2010). The latter uses non-public data from the US Market Authority (CFTC) to show that the correlations between the returns of investable commodities and equity indices increase amid greater participation by hedge funds. Tang and Xiong, on the other hand, find that since the early 2000s futures prices of non-energy commodities in the US became increasingly correlated with oil, and that this trend is systematically more pronounced for commodities included in the two most popular commodity indices. On the basis of this result, they suggest that index traders may have played an important role in affecting commodity prices.

Data

Information about HRW wheat futures prices comes from the Kansas City Board of Trade, the centralized exchange in which these contracts are traded. We calculated a weekly weighted average futures price, with weights equal to the trading volumes of each contract.

- HRW wheat spot price time-series comes from the U.S. Department of Agriculture (USDA).
- S&P 500 index, used by countless empirical works as a proxy for the US equity market performance, is available from the Standard & Poor's website. We chose it among other indices because it is representative of the whole market.
- US Dollar exchange rate dynamics are measured by the Trade Weighted Exchange Index calculated by the Federal Reserve.
- S&P-GSCI commodity index returns come from Goldman Sachs and were

downloaded from the website 'Wikiposit'

- Brent futures price and gasoline price are made available by the U.S. Energy Information Administration.
- Data on futures market operations and net speculative positions were compiled by the U.S. market authority (the Commodity Futures Trading Commission, CFTC) and published in its “CIT Supplementary Report”.

In all regressions we used weekly observations of each variable.

Preliminary analysis of the futures price time-series

A preliminary analysis of the futures price time-series revealed the following relevant characteristics: (1) the variable in levels is not stationary, while its first difference logarithmic transformation is stationary (2) there is a first-order positive serial correlation (3) there is autoregressive conditional heteroskedasticity[3] (3) The error distribution carries more weight in the tails than a normal distribution, so it is better approximated by a student-t. These aspects were highlighted by formal tests.

Correlation between spot price and futures price

Commodity futures markets were created (also) with the aim to provide commercial operators with a benchmark price for their physical transactions. In other words, the spot price of a commodity is settled on the basis of the futures price determined by the financial market. If this relation holds, we expect the two prices to be highly correlated. A preliminary visual analysis (Figure 3.1) doesn't appear to contradict our hypothesis of a strong correlation. In effect, the correlation coefficient between the two series in levels is 98.5%, while between the two series in first-differenced natural logarithms is 90.2%.

If we estimate a mixed autoregressive distributed lag model ADL (3,3) to describe the relationship between the two variables, we obtain the following result [to simplify, we show ∆*ln(futures price)* simply as *f*, and ∆*ln(spot price)* simply as *s*].

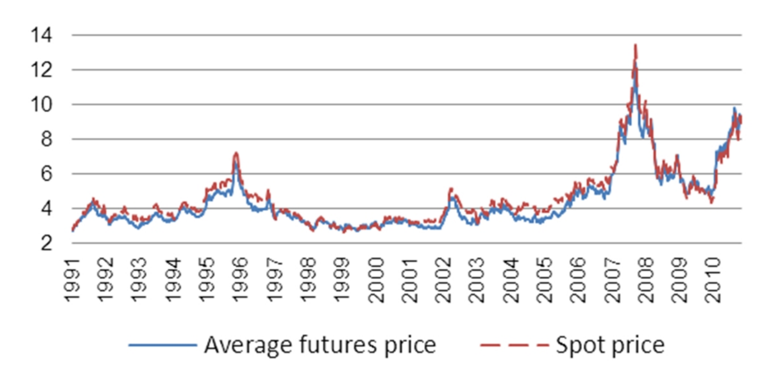
[3] A time-series presents conditional heteroskedasticity, or volatility clusters, if there is an alternation between periods of higher and lower volatility.

Regression 1 – Spot and futures price

$$\begin{array}{lcccccccc} s_t = & 0.000004 + & 0.20 s_{t-1} & +0.05 s_{t-2} & -0.07 s_{t-3} & +\mathbf{0.94} f_t & -0.16 f_{t-1} & -0.08 f_{t-2} & +0.09 f_{t-3} \\ (t-stat) & (0.10) & (4.52) & (1.58) & (-2.01) & (\mathbf{60.38}) & (-3.51) & (-2.50) & (2.29) \end{array}$$

$$N = 1002;\ R^2 = 0.830\ ;\ Adjusted\ R^2 = 0.829;$$

Figure 3.1 –HRW wheat spot and futures price



Source: Author's own elaboration and computations on KCBT and USDA data

Standard errors (and consequently t-statistics) are Newey-West HAC (Heteroskedasticity and Autocorrelation Consistent), so they are unbiased and consistent. The intercept is not significantly different from zero. Coefficients are all significant at the 95% confidence level, except for the second-order autoregressive coefficient - AR(2). The f_t coefficient is different from zero at the 99.9% confidence level, and its expected value of 0.94 suggests an almost unitary elasticity of spot price to the current weighted average futures price. Not surprisingly, past values of the futures price help in predicting the current spot price. Nevertheless, if we re-estimate this same equation excluding the current average futures price from the regressors, the R^2 declines to 0.045. It is the current values of the futures price variations which explain the most part of the spot price variability. A Quandt-Andrews unknown breakpoint test (QLR) shows that we cannot reject the null hypothesis of no structural break at any confidence level. In other words, the estimated relationship appears to be stable in the period considered (1991-2011). In conclusion on this first point, HRW wheat spot and futures prices move together, and at almost the same pace.

Price and the market share of speculators

In the period 2006-2010 we find a significant (and positive) correlation between futures price shifts and the market share of speculators (measured by the ratio between their net positions and the overall open interest of the market). Using a Garch(1,1)-t model (more efficient than OLS in presence of conditional heteroskedasticity) we obtain the following estimates.

Regression 2 – Price and the market share of financial speculators

$$\begin{array}{lllll} \boldsymbol{\Delta \ln(Pwheat)_t} = & 0.003 + & 0.13 * \Delta \ln \ Pwheat_{\ t-1} + & \boldsymbol{0.49 * \Delta \ speculation\%_{\ t}} \\ \boldsymbol{(p-value)} & (0.24) & (0.03) & \boldsymbol{(0.0000)} \end{array}$$

$$\begin{array}{llll} h_t = & 10^{-5} * 3.2 + & 0.06 * \varepsilon_{t-1}^2 + & 0.92 * h_{t-1} \\ (p-value) & (0.31) & (0.06) & (0.0000) \end{array}$$

$$\boldsymbol{N} = 261 \ ; \boldsymbol{R^2} = 0.13 \ ; \boldsymbol{Adjusted \ R^2} = 0.11; \boldsymbol{F-stat} = 6.3; \ \boldsymbol{p-value \ (F \ stat)} = 0.000003$$

For each percentage point increase in the market share of financial speculators on the Kansas City Board of Trade, the HRW wheat price tends to increase by one half percentage point. Such relation appears to be stable in the period considered (we found no evidence of a structural break). It is important to clarify that this result does not necessarily imply that speculators *cause* wheat price dynamics. The opposite could also happen, *i.e.* that a larger number of financial investors join the market when prices are higher, or there could be other macroeconomic variables affecting both the wheat price and the market share of speculators.

Wheat price and financial markets – an indirect approach based on conditional correlations

As indicated by many authors (for example Buyuksahin and Robe, 2010, Tang and Xiong, 2010, UNCTAD 2009), financial investors are able to create connections between the different markets in which they operate. In this second analysis we investigate the conditional correlations between HRW wheat, the US equity market, and the oil market.

Wheat price, stock market returns, and the S&P-GSCI commodity index.

First of all, we verify if stock market dynamics have any impact on wheat prices. We include in the regression, as a control variable, the Federal Reserve index of the US

Dollar's average value, because we know that the US dollar exchange rate is correlated with both equity returns and wheat prices. For the period between January 1986 and April 2011, we obtain the following.

Regression 3 – Wheat price and stock market dynamics

$$\begin{array}{ccccc} \boldsymbol{\Delta \ln(Pwheat)_t} = & 0.00034 + & 0.17 * \Delta \ln \, Pwheat_{\,t-1} + & 0.09 * \Delta \ln \, S\&P\,500_{\,t} - & 0.45 * \Delta \ln \$_t \\ \boldsymbol{(p-value)} & (0.67) & (0.0000) & (0.049) & (0.0000) \end{array}$$

$$\boldsymbol{N} = 1.328 \,; \boldsymbol{R^2} = 0.06 \,; \boldsymbol{Adjusted\ R^2} = 0.05; \boldsymbol{F-stat} = 26.9; \ \boldsymbol{p-value}\ (\boldsymbol{F\ stat}) = 0.000000$$

We estimate a simple OLS model, unbiased and consistent, but in this case not efficient because of the presence of heteroskedasticity. However, we use it to simply test for potential structural breaks, and to estimate a breakpoint date. Standard errors are Newey-West HAC (Heteroskedasticity and Autocorrelation Consistent), i.e. they are calculated in such a way that they are unbiased and consistent even in the presence of heteroskedasticity and serial correlation.

The marginal effect of the S&P 500 coefficient is statistically significant but quite weak. Small wonder that the US dollar coefficient is negative and significant, given that which was stated in the first section. Considering that many new factors intervened during the period considered, it seems appropriate to check for structural breaks. If there are structural breaks, the estimated coefficients would be rather meaningless, representing an “average” between significantly different periods. Indeed a recursive estimation of the coefficients (Figure 3.2) is indicative of a rather strong structural break, which is confirmed by a Quandt-Andrews unknown breakpoint test (QLR statistic, Figure 3.3).

The QLR statistic, which we calculated with a 5% truncation[4], indicates the last week of June 2008 as the most probable breakpoint date for the S&P 500 coefficient, and the last week of August 2008 for the US Dollar coefficient, while it doesn't indicate a significant break for the AR(1) coefficient (contrary to what Figure 3.2 seems to suggest). However, the QLR statistics appear to suggest that these structural breaks may have been rather gradual. For the S&P 500 coefficient, the null hypothesis of no

[4] The most common choice is to use a 15% truncation. In this case, we have many observations (N=1,328) and we need to search for the break in the final part of the sample, so a 5% truncation is more appropriate.

structural break can be rejected for all observations between August 2002 and January 2010, while for the US Dollar coefficient we can reject it for all observation between June 1993 and October 2009. It is true that the strong intensity of the break may explain the large extent of these ranges, but on the other hand the dynamic of the QLR test statistic is really suggestive of a rather gradual structural break.

In considering the following figures, we have to consider that the recursive estimation of coefficients tends to 'overestimate' the breakpoint date (i.e. it tends to find the breakpoint later than when it really happened), while the QLR test tends to anticipate the real breakpoint date, all the more when the break is so drastic. However, the overall indication seems to be that both structural breaks started gradually in the early 2000s, and intensified in 2007/2008.

Figure 3.2 – Recursive estimation of the coefficients of regression 3

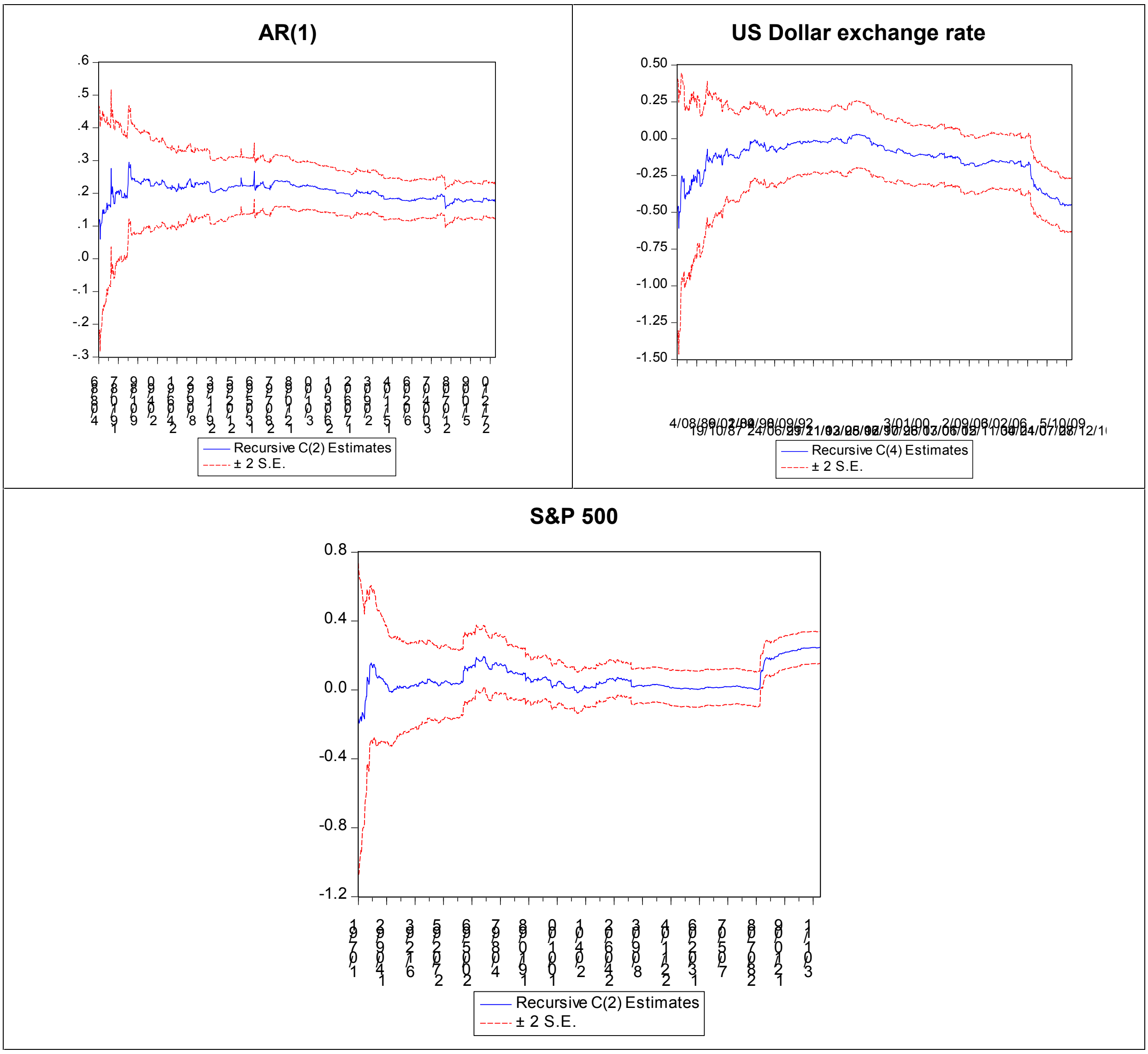
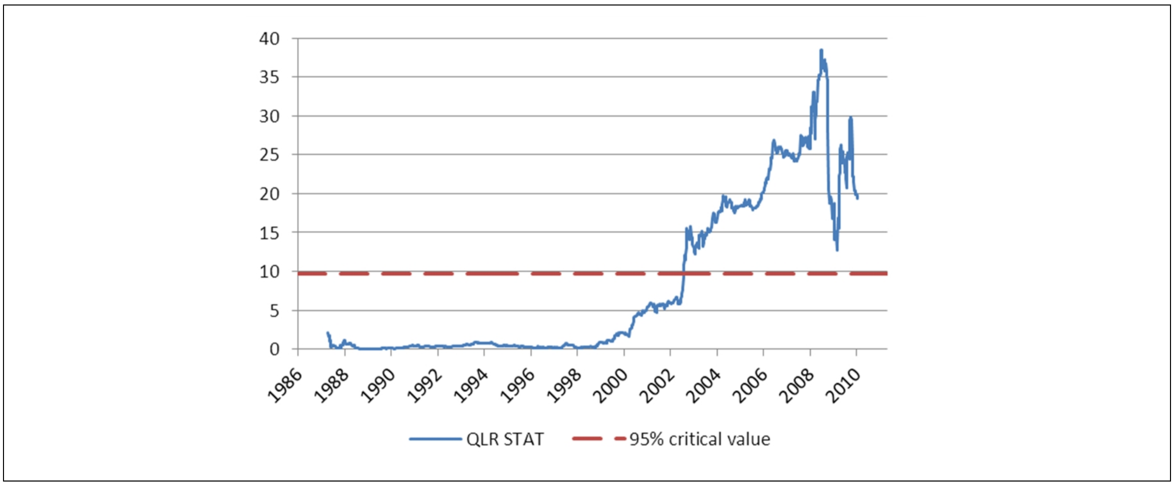


Figure 3.3 – QLR test statistic for the S&P 500 coefficient



The next step is to estimate the same equation separately for the two periods, as suggested by the QLR test statistic. At this stage, we estimate a Garch(1,1)-t model. In the presence of heteroskedasticity, this model allows us to obtain a more efficient estimate for the conditional mean, so it is preferable to OLS even if we are not interested in the conditional variance parameters. We choose 2007 as the breakpoint date, given what we stated above. The post-break equation is estimated twice. In the second one (marked by an asterisk) we control – by means of a dummy variable – for the global recession of 2008/2009, when commodity prices and stock market indices went down simultaneously. We do so in order to be sure that the correlation we found is not simply the effect of this period of recession, when most economic variables went down simultaneously because of the downturn. Basically, what we do is to exclude from the parameters estimation the period which is highlighted by the blue area in Figure 3.4. The results obtained are summarized in Table 3.1.

The temporal evolution of the coefficients' estimates is interesting. US stock market returns and wheat price movements, uncorrelated until 2006, become positively related in the period 2007-2011, in a statistically significant way (at a 98.6% confidence level). The negative correlation between wheat price dynamics and the US dollar exchange rate is significant even in the 1986-2006 period, but in the late 2000s it became much higher, passing from an estimated coefficient of 0.10 to an almost unitary one. The evolution of the R^2 of the model is interesting too. Until 2006 AR(1), equity index and the US dollar accounted for only 4% of wheat price variability. In 2007-2011, they accounted for 17%. A considerable share if one considers that it is referred to the percent change of a financial derivative instrument.

Summing up, during the late 2000s we observe the development of a positive, statistically significant and considerable correlation between HRW wheat price dynamics and US stock market returns. This correlation was not observable in the previous period. Now we can test the hypothesis that this correlation be determined by commodity index traders. As mentioned before, HRW wheat is part of the S&P-GSCI commodity index, with a weight that oscillates yearly between 1 and 2 percentage points. The regression reported in Table 3.2 shows that S&P-GSCI is the confounding variable which determines the correlation between US stock market returns and wheat price fluctuations.

Table 3.1 – Correlation between HRW wheat price and stock market returns – Garch (1,1)-t model

	DEPENDENT VARIABLE:	**$\Delta ln(Pwheat)_t$**	
Explicative variables		Coefficients (p-values)	
	1986-2006	2007-2011	2007-2011°
Constant	0.0002 (0.80)	0.0009 (0.74)	0.002 (0.44)
AR(1)	**0.18*** (0.0000)**	**0.14** (0.04)**	**0.13** (0.05)**
$\Delta ln(S\&P\ 500)_t$	0.008 (0.80)	**0.28** (0.03)**	**0.26** (0.05)**
$\Delta ln(\$)_t$	-0.10 (0.19)	**-0.97*** (0.0002)**	**-0.95*** (0.0002)**
	Conditional variance		
Constant	0.00004 (0.007)	0.00009 (0.47)	0.00008 (0.50)
Arch (ε^2_{t-1})	0.11 (0.0000)	0.04 (0.22)	0.04 (0.25)
Garch (h_{t-1})	0.81 (0.0000)	0.90 (0.0000)	0.90 (0.0000)
	Regression statistics		
N	1,101	227	227
R^2(Adjusted R^2)	**0.04 (0.03)**	**0.16 (0.13)**	**0.17 (0.14)**
F-stat (p-value)	**5.8 (0.000001)**	**5.9 (0.000002)**	**5.5 (0.000002)**

°Including a dummy variable which controls for the effect of the global recession of 2008-2009 (see figure 3.4)
Note: p-values are in parenthesis. Coefficients estimates are noted as significant at the 1%(***), 5%(**) and 10%(*) levels. For 2011 our data only cover the first four months. Coefficients that are significantly different from 0 at the 10% level are noted in bold. All variables are expressed in first differences of the natural logarithm

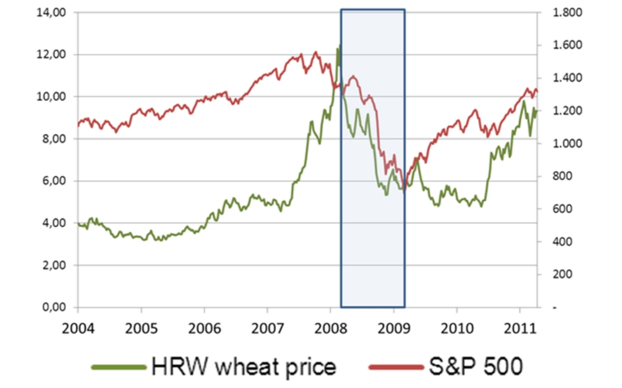
Table 3.2 – The correlation between wheat price and stock market returns fades away when we control for the most tracked commodity index (S&P-GSCI) – Garch (1,1)-t model

	DEPENDENT VARIABLE:	$\Delta\ln(Pwheat)_t$	
Explicative variables		Coefficients (p-values)	
	1991-2006	2007-2011	2007-2011°
Constant	0.0005	0.0009	0.002
	(0.51)	(0.73)	(0.49)
AR(1)	**0.17*** **	**0.15** **	**0.14** **
	(0.0000)	**(0.02)**	**(0.2)**
$\Delta\ln(S\&P\ 500)_t$	-0.04	0.25	0.10
	(0.38)	(0.43)	(0.49)
$\Delta\ln(S\&P\text{-}GSCI)_t$	**0.15*** **	**0.25*** **	**0.25*** **
	(0.0000)	**(0.0006)**	**(0.0009)**
$\Delta\ln(\$)_t$	-0.13	**-0.79*** **	**-0.78*** **
	(0.24)	**(0.001)**	**(0.001)**
	Conditional variance		
constant	0.000005 (0.03)	0.00008 (0.28)	0.00009 (0.30)
Arch (ε^2_{t-1})	0.10 (0.001)	0.04 (0.22)	0.04 (0.3)
Garch (h_{t-1})	0.81 (0.0000)	0.90 (0.0000)	0.90 (0.0000)
	Regression statistics		
N	837	226	226
R^2(Adjusted R^2)	0.06	0.21	0.22
	(0.05)	(0.18)	(0.19)
F-stat (p-value)	**7.11**	**7.35**	**6.68**
	(0.000000)	**(0.000000)**	**(0.000000)**

°Including a dummy variable which controls for the effect of the global recession of 2008-2009 (see figure 3.4)
Note: p-values are in parenthesis. Coefficients estimates are noted as significant at the 1%(***), 5%(**) and 10%(*) levels. For 2011 our data only cover the first four months. Coefficients that are significantly different from 0 at the 10% level are noted in bold. All variables are expressed in first differences of the natural logarithm

When we control for the S&P-GSCI index, the correlation between wheat price and US stock market loses statistical significance. In other words, S&P-GSCI is the mediating factor which determines the correlation between wheat price dynamics and US stock market returns. This result corroborates the hypothesis that commodity index traders affect price dynamics, linking them to the US stock market fluctuations.

Figure 3.4 – The period “excluded” from the third regression



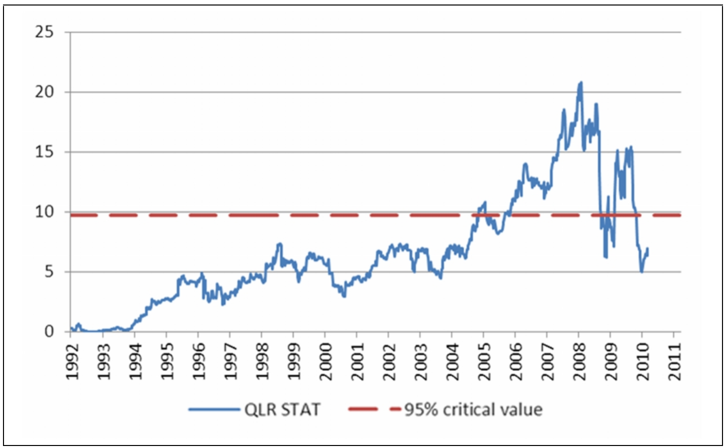
Wheat price and the price of oil

Let us now consider the relation between HRW wheat price and oil price. Oil is the main component of the S&P-GSCI index. In a recent paper (2010) Tang and Xiong show that in recent years futures prices of non-energy commodities became increasingly correlated with oil, and that this trend is systematically more pronounced for commodities included in the two most popular commodity indices. The results we find here are coherent with Tang and Xiong’s findings, and add further new elements which support the hypothesis that commodity index traders influenced recent wheat price fluctuations.

An estimation covering the entire sample (January 1991-april 2011) produced a QLR test statistic for structural breaks which indicates March 2008 as the most probable breakpoint date. As in the case of the US stock market coefficient, the dynamic of the QLR test statistic is suggestive of a gradual structural break, which has developed during the second half of the decade (Figure 3.5). In other words, HRW wheat dynamics and oil price movements gradually developed a correlation during the late 2000s.

We include in the regression, as control variables, the US Dollar exchange rate and gasoline price. Controlling for the US dollar exchange rate dynamics allows us to exclude from the analysis co-movements which are due just to the common measuring rod. Controlling for the price of gasoline allows us to exclude from the analysis that part of the correlation between oil price and wheat price which is determined by the impact of the demand for biofuels. If the correlation between oil price and wheat price was entirely due to biofuels production, it would be spurious, and should fade away when controlling for gasoline price (it is the gasoline price, and not the crude oil price, that determines the profitability of biofuels).

Figure 3.5 – QLR test statistic for the $\Delta \ln(oil)_t$ coefficient



In table 3.3 we present the models' estimations for the two different periods – pre- and post-structural break - as suggested by the QLR statistics. Oil price and wheat price, uncorrelated until 2006, become significantly correlated in the period 2007-2011.

The gasoline price coefficient, as predicted, is not significant in 1991-2006, but significant in 2007-2011. In other words, we find that since 2007 gasoline price has had an impact on wheat price – so biofuels demand is probably an important factor – but that it explains only a minor part of the link between wheat price and oil price.

As before, the post-break equation is estimated twice, in order to control for the effect of the global recession.

Even the relation between wheat price and oil price appears to be ascribable to commodity index traders. As shown in Table 3.4, the link between oil price and wheat price is spurious, and the mediating factor is, once again, the S&P-GSCI index.

Table 3.3 – Correlation between wheat price and oil price; Garch(1,1)-t model

	DEPENDENT VARIABLE:	$\Delta\ln(\text{Pwheat})_t$	
Explicative variables		Coefficients (p-values)	
	1991-2006	2007-2011	2007-2011°
Constant	0.0005	0.0006	0.004
	(0.57)	(0.82)	(0.23)
AR(1)	**0.18*** **	**0.14** **	**0.14** **
	(0.0000)	**(0.03)**	**(0.03)**
$\Delta\ln(\text{Brent})_t$	0.008	**0.14** **	**0.12** **
	(0.69)	**(0.02)**	**(0.03)**
$\Delta\ln(\$)_t$	-0.16	**-1.18*** **	**-1.14*** **
	(0.13)	**(0.0000)**	**(0.0000)**
$\Delta\ln(\text{Gasoline})_t$	-0.03	-0.15	**-0.20** **
	(0.56)	(0.15)	**(0.049)**
	Conditional variance		
Constant	$6*10^{-5}$	$7*10^{-5}$	0.0007
	(0.02)	(0.40)	(0.40)
Arch (ε_{t-1}^{2})	0.11	0.04	0.10
	(0.001)	(0.21)	(0.34)
Garch (h_{t-1})	0.80	0.91	0.44
	(0.0000)	(0.0000)	(0.47)
	Regression statistics		
N	836	227	227
R^2(Adjusted R^2)	0.04 (0.03)	0.17 (0.14)	0.18 (0.15)
F-stat (p-value)	**3.9 (0.0002)**	**5.66 (0.000002)**	**5.43 (0.000001)**

°Including a dummy variable which controls for the effect of the global recession of 2008-2009 (see figure 3.4)
Note: p-values are in parenthesis. Coefficients estimates are noted as significant at the 1%(***), 5%(**) and 10%(*) levels. For 2011 our data only cover the first four months. Coefficients that are significantly different from 0 at the 10% level are noted in bold. All variables are expressed in first differences of the natural logarithm

Table 3.4 – The correlation between wheat price and oil price fades away when we control for the most tracked commodity index (S&P-GSCI); Garch (1,1)-t model

	DEPENDENT VARIABLE:	Δln(Pwheat)	
Explicative variables		Coefficientis (p-values)	
	1991-2006	2007-2011	2007-2011°
Constant	0.0003	0.0003	0.002
	(0.66)	(0.91)	(0.53)
AR(1)	**0.17*** **	**0.17*** **	**0.17*** **
	(0.0000)	**(0.01)**	**(0.01)**
Δln(Brent)$_t$	**-0.06*** **	0.02	0.02
	(0.01)	(0.76)	(0.80)
Δln(S&P-GSCI)$_t$	**0.19*** **	**0.29*** **	**0.28*** **
	(0.0000)	**(0.0001)**	**(0.0001)**
Δln($)$_t$	-0.13	**-0.94*** **	**-0.92*** **
	(0.20)	**(0.0001)**	**(0.0000)**
Δln(Gasoline)$_t$	0.001	-0.16	**-0.18**
	(0.98)	(0.11)	**(0.08)**
	Conditional variance		
Constant	5.3^{-5}	7.8^{-5}	8.1^{-5}
	(0.03)	(0.34)	(0.39)
Arch (ε^2_{t-1})	0.10	0.05	0.04
	(0.001)	(0.24)	(0.29)
Garch (h_{t-1})	0.81	0.90	0.90
	(0.0000)	(0.0000)	(0.0000)
	Regression statistics		
N	836	227	227
R^2(Adjusted R^2)	0.07 (0.06)	0.23 (0.19)	0.23 (0.20)
F-stat (p-value)	**6.57 (0.000000)**	**7.10 (0.000000)**	**6.6 (0.000000)**

°Including a dummy variable which controls for the effect of the global recession of 2008-2009 (see figure 3.4)
Note: p-values are in parenthesis. Coefficients estimates are noted as significant at the 1%(***), 5%(**) and 10%(*) levels. For 2011 our data only cover the first four months. Coefficients that are significantly different from 0 at the 10% level are noted in bold. All variables are expressed in first differences of the natural logarithm

IV. Interpretation of results and concluding remarks

The first analysis (Regression 2) is a direct one, and shows that for each percentage point increase in the market share of financial speculators, the HRW wheat price tends to increase by one half percentage point. We must be really careful in interpreting this result, because we are not able to state if there is a causality relation between the two variables, and even if we assume that there is one, we don't know its direction. There could be an omitted variable bias (a third variable may influence both the market share of speculators and the wheat price), or there could be a reverse causality (which means that it is the level of prices which gives financial speculators an incentive to join the market or to exit from it). The hypothesis which seems to us to be more likely is the one of simultaneous causality, *i.e.* high prices represent an incentive for speculators to join the market, but at the same time financial speculators are net buyers so they push prices up. However, we are not able to test empirically this hypothesis of simultaneous causality. Another flaw of this first analysis is that we don't have data for the previous period, so we can't check for structural breaks due to the financialization of commodity markets.

The second analysis is based on longer time-series, and it focus on the relationships between wheat price dynamics and financial markets. In the period 1986-2006 wheat price dynamics and stock market returns are uncorrelated, while in the period 2007-2011 we find a statistically significant positive correlation. In the same period, and following a similar (and quite gradual) pattern (as indicated by the QLR test statistics), wheat prices developed a correlation with oil prices, while the correlation with the US dollar exchange rate strengthened remarkably. Given the facts presented in the second section, our hypothesis is that financial investors, and in particular commodity index traders, played the main role in determining these correlations. These financial actors are active at the same time in equity, agricultural commodity and energy commodity markets. It is difficult to believe that their strategies in the different markets in which they operate can be independent from each other. The results reported in Tables 3.1-3.4 support this hypothesis. The relationships between wheat prices, stock market returns and oil prices appear to be spurious, and mediated by the S&P-GSCI, the most popular commodity index.

In interpreting the positive sign of the correlation between the price of wheat and US

stock market returns, we argue that when stocks' market value increases, diversification incentives induce investors to move some money into commodities (Tang and Xiong 2010).
As for the positive correlation between oil prices and wheat prices, we argue that it is due to the way commodity index funds work. Oil is the main component of all the most popular commodity indices. When the price of oil increases, index traders automatically raise their investment in all the other commodities included in the index, in order not to alter the fixed weights of the index.

The relationship between wheat prices and the US Dollar exchange rate seems to be more complicated, and only partially ascribable to commodity index traders. The US dollar exchange rate appears to have had a huge impact on recent wheat price dynamics. This relationship was present even in the previous period, and its sign is negative. This is coherent with the fact that commodities are priced in dollars, so we expect exporters to raise prices when the dollar depreciates, especially in oligopolistic markets, in order to keep (*ceteris paribus*) real prices fixed. However, the impact of the US dollar exchange rate became remarkably stronger after 2007, so new factors must have stepped in. We suppose that financial investors played a role, because they see commodities as a hedge against the US dollar depreciation, but our estimates show that only a minor part of this influence can be attributed to index traders. We can suppose that active investors (which we called 'money managers' in the second section) were more influential in this regard, because they are more reactive to macroeconomic signals, but there may even have been other factors behind the relationship, which leaves room for further research.

Highlighting the influence of index traders on recent wheat price dynamics, our work contributes to the debate on the role of financial markets in recent food price swings, and on the need for better regulated commodity futures markets. Our empirical analysis suggests that financial investors played an important role in affecting wheat price fluctuations in recent years. In particular they seem to have linked wheat price dynamics to US equity market returns and to oil price movements. The commodity index S&P-GSCI is the confounding variable, which determines the linkage between wheat price dynamics, stock market returns, and oil price movements. What are the policy implications of these empirical results? In our opinion they suggest that the process of deregulation of commodity derivative markets, which started around the Nineties, went too far and should now be reversed. Position limits should be increased, and commodity index traders should not be exempted from them (as they have been since 1991). The jurisdiction of market authorities should be extended to OTC transactions, and to the markets which now are almost completely unregulated (such as the ones in London). The Dodd-Frank Act, recently approved in the US, is a step in this direction, in that it provides for the centralization and regulation of OTC transactions. It remains to be seen how it will be implemented by the US market authority (CFTC). Moreover, coordination between market authorities, coupled with the imposition of analogous rules in all the main commodity exchanges, would be necessary to impede investors bypassing rules and limits simply by trading the same commodity on different exchanges. Commodity derivatives were created to stabilize price dynamics. As a result of their uncontrolled expansion, they now appear to be a factor of destabilization.

References

Abbott P.C., Hurt C., Tyner W.E. (2008) What's Driving Food Prices?, Farm Foundation Issue Report (FFIR), Oak Brook, IL

Abbott P.C., Hurt C., Tyner W.E. (2009) What's Driving Food Prices? March 2009 Update, Farm Foundation Issue Report (FFIR), Oak Brook, IL

Andrews D.W.K. (2003) Tests for parameter instability and structural change with unknown change point: A corrigendum. *Econometrica*, 71, 395-397

Basu P., Gavin T.W. (2011) What explains the growth in commodity derivatives? *Federal Reserve Bank of St. Louis Review*, 93, 37-84

Buyuksahin B., Haigh M.S., Robe M.A. (2008) Commodities and equities: a 'market of one'?, Working Paper, CFTC, June 9, 2008.

Buyuksahin B., Robe M.A. (2010) Speculators, commodities and cross-market linkages. Available at SSRN: http://ssrn.com/abstract=1707103

Dawe D. (2009) The unimportance of "low" world grain stocks for recent world price increases, FAO Esa working paper no.09-01

De Hoyos R., Medvedev D. (2009) Poverty effects of higher food prices, World Bank policy research working paper No.WPS4887

De Schutter O. (2010) Food commodities, speculation and food price crisis, UN Special Rapporteur on the right to food, briefing note 02

FAO (2009) The State of Agricultural Commodity Markets

Gilbert C.L. (2008) How to understand

Gilbert C.L. (2009) Speculative influences on commodity futures prices 2006-08. Unctad discussion paper No.197

Goldman Sachs & Co. (2004) The case for commodities as an asset class. Available at http://www.authorstream.com/Presentation/Janelle-63469-GSCI-Strategic-June-2004-Executive-SummaryGSCI-Portfolio-Diversifier-Enhancer-Estimated-Education-ppt-powerpoint/

Gorton G., Rouwenhorst K.G., (2004) Facts and fantasies about commodity futures, *Financial Analysts Journal*, March/April 2006, 62(2), pp.47-68

Hernandez M., Torero M. (2010) Examining the dynamic relationship between spot and futures prices of agricultural commodities. Ifpri discussion paper No.988

IATP (2008) Commodities market speculation: the risk to food security and agriculture. Available at http://www.iatp.org

IATP (2011) Excessive speculation in agriculture commodities – Selected Writings 2008-2011. Available at http://www.iatp.org/documents/excessive-speculation-in-agriculture-commodities

IMF (2008) World Economic Outlook

Irwin S.H, Sanders D.R., Merrin R.P. (2009) A speculative bubble in commodity futures prices? Cross-sectional evidence, in *Proceedings of the NCCC-134 Conference on Applied Commodity Price Analysis, Forecasting, and Market Risk Management*

Irwin S.H., Sanders D.R. (2011) Index funds, financialization, and commodity futures markets, *Applied Economic Perspectives and policy advance access*, February 2011, pp.1-31

Masters M.W., White A.K., (2008) The accidental Hunt brothers, how institutional investors are driving up food and energy prices. Available at http://www.accidentalhuntbrothers.com

Mitchell D. (2008) A note on rising food prices, World Bank Policy Research Working Paper No.4682

OECD (2008) Rising Food Prices, Causes and Consequences. Available at http://www.oecd.org/dataoecd/54/42/40847088.pdf

Orleàn A. (2011) Dall'euforia al panico. Pensare la crisi finanziaria e altri saggi, Ombre Corte, Verona

Tang K., Xiong W. (2010), Index investment and financialization of commodities. NBER Working Paper No.16325

Timmer P. (2008) Causes of high food prices, Asian Development Bank Working Paper Series No.128

UNCTAD (2009) Trade and Development Report 2009, Chapter II

UNCTAD (2011) Price formation in financialized commodity markets. Available at http://www.unctad.org/en/docs/gds20111_en.pdf

USDA Economic Research Service (2011) Why have Food Commodity Prices Risen Again? Available at http://www.ers.usda.gov/Publications/WRS1103/WRS1103.pdf

US Senate Committee on Homeland Security and Governmental Affairs, Permanent Subcommittee on Investigations (2009) Excessive Speculation in the wheat market. Available at http://hsgac.senate.gov/public/_files/REPORTExcessiveSpecullationintheWheatMarketwoexhibitschartsJune2409.pdf

Wahl P. (2009) Food speculation as the main factor of the price bubble in 2008, briefing paper, World Economy, Ecology & Development, 6-7

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